REMARKS/ARGUMENTS

The specification and claims have been amended herein to improve their form for U.S. examination

Respectfully submitted,

Gregory C. Bays, Reg. No. 40,515
LEYDIG, VOIT & MAYER, LTD.
Two Prudential Plaza, Suite 4900
180 North Stetson Avenue
Chicago, Illinois 60601-6780
(312) 616-5600 (telephone)
(312) 616-5700 (facsimile)

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~~Yarn Measuring Device, in Particular for Nonstationary Applications~~

HAND HELD YARN MEASURING DEVICE

FIELD OF THE INVENTION

[0001] The present invention relates to yarn measuring devices for use with yarn processing machines, and more particularly, to a hand-operated yarn measuring device.

BACKGROUND OF THE INVENTION

[0002] Machines that use yarn often draw many individual yarns from so-called creels, and the yarns then travel to the machine. In practice, there is sometimes a need to be able to determine the yarn quantity and/or yarn speed of the yarns traveling to the machine. For that purpose, a yarn measuring device is known, such as disclosed in German Published Patent Application DE-OS 2557593, which is a hand-operated measuring instrument suitable for freehand measurements. This yarn measuring device has a pistol-shaped two-legged housing, one leg of which forms a handle and the other leg of which has a yarn catcher on its free end. The yarn catcher is formed by a pivotably supported lever, which has a peg with a thickened head on its free end that serves as a yarn guide element. A drum that is connected to a rotary speed measuring device is rotatably supported concentrically with the axis of rotation of the pivot lever. The pivot lever is connected, via a rack drive mechanism, to an actuating lever that is accessible on the front of the housing part that forms the handle. It can be moved onto the handle, counter to the force of a pre-stressing spring, causing the pivot lever to execute a pivoting motion of approximately 180°. If a yarn was previously engaged from behind with its yarn guide element, then the yarn is as a result placed on the rotatably supported drum, which is thus set into rotation by the yarn motion. The rotary speed of the drum is a measure for the yarn speed.

~~The invention relates to a yarn measuring device which is intended in particular as a hand-operated measuring instrument.~~

[0003] Measuring the yarn speed in the foregoing manner is adequate for some applications. However, the need exists for a more-versatile yarn measuring device.

~~Machines that use yarn often draw many individual yarns from so-called creels, and the yarns then travel to the machine. In practice, there is sometimes a need to be able to determine the yarn quantity and/or yarn speed of the yarns travelling to the machine. For that purpose, a yarn measuring device is known for instance from German Published, Non-examined Patent Application DE-OS 2557593, which is constructed as a hand-operated measuring instrument and is suitable for freehand measurements. This yarn measuring device has a pistol-shaped two-legged housing, one leg of which is embodied as a handle and the other leg of which has a yarn catcher on its free end. The yarn catcher is formed by a pivotably supported lever, which has a peg with a thickened head on its free end as a yarn guide element. A drum that is connected to a rotary speed measuring device is rotatably supported concentrically with the axis of rotation of the pivot lever. The pivot lever is connected, via a rack drive mechanism, to an actuating lever that is accessible on the front of the housing part that forms the handle. It can be moved there onto the handle, counter to the force of a prestressing spring, causing the pivot lever to execute a pivoting motion of approximately 180°. If a yarn was previously engaged from behind with its yarn guide element, then the yarn is as a result placed on the rotatably supported drum, which is thus set into rotation by the yarn motion. The rotary speed of the drum is a measure for the yarn speed.~~

OBJECTS AND SUMMARY OF THE INVENTION

[0004] It is an object of the present invention to provide a more versatile hand held yarn measuring device that this adapted for measuring and/or monitoring a number of operating parameters of moving yarn in a yarn processing machine or the like.

~~Measuring the yarn speed is adequate for some applications. However, a more versatile use of the yarn measuring device is a goal. It is precisely this which the present invention makes possible.~~

[0005] The yarn measuring device of the invention is particularly suited for freehand measurements. It has a housing with a handle and an actuating device is provided on the handle. The yarn measuring device also has a yarn catcher, which is supported for adjustable positioning between a tuck position and a measuring position. It can be moved back and forth between its tuck position and its measuring position, via an actuating mechanism, and by means of the actuating device. A yarn guide element also is provided, by way of which the yarn catcher, when it is in the measuring position, guides the yarn. Between the yarn guide element and the yarn catcher when the measuring position, a yarn tension meter is provided, which serves to detect the yarn tension and furnishes an electrical signal

accordingly. This creates one basic operating feature for more-versatile use of the yarn measuring device. Not only can the yarn speed or yarn quantity be measured, but also the yarn tension, which substantially broadens the range of application of the hand-operated measuring instrument. With the arrangement of the invention, a further feature involves measuring the yarn tension virtually independently of the skill of the user. The angle at which the yarn measuring device is held relative to the yarn does not matter, nor is any manual skill necessary. The yarn travels to both sides of the yarn tension meter via one yarn guide element on each side so that the angle at which the yarn brushes over the yarn tension meter is correctly defined without any action on the part of the user. Incorrect measurements can thus be avoided. The yarn also is hardly capable of jumping off the yarn measuring device during measurement, even if the yarn measuring device is not being held entirely parallel to the yarn.

[0006] The yarn guide element carried by the yarn catcher preferably is a yarn spool that is rotatably supported with little friction and is set into rotation by the yarn. This makes accurate yarn tension measurements possible. ~~The yarn measuring device of the invention is suited in particular for freehand measurements. It has a housing with a handle and an actuating device provided on the handle. The yarn measuring device also has a yarn catcher, which is supported movably adjustable between a tuck position and a measuring position. It can be moved back and forth between its tuck position and its measuring position via an actuating mechanism and by means of the actuating device. A yarn guide element is also provided, by way of which the yarn catcher, when it is in the measuring position, guides the yarn. Between the yarn guide element and the yarn catcher, that is in the measuring position, a yarn tension meter is provided, which serves to detect the yarn tension and furnishes an electrical signal accordingly. This creates one basic prerequisite for more versatile use of the yarn measuring device. Not only can the yarn speed or yarn quantity be measured, but also the yarn tension, which broadens the range of application of the hand operated measuring instrument substantially. With the arrangement of the invention, a prerequisite is moreover created for measuring the yarn tension virtually entirely independently of the skill of the user. The angle at which the yarn measuring device is held relative to the yarn does not matter, nor is any manual skill necessary. The yarn travels to both sides of the yarn tension meter via one yarn guide element on each side, so that the angle at which the yarn brushes over the yarn tension meter is correctly defined without any action on the part of the user. Incorrect measurements can thus be avoided. The yarn is also hardly capable of jumping off the yarn measuring device during measurement, even if the yarn measuring device is not being held with its handle entirely parallel to the yarn.~~

~~The yarn guide element carried by the yarn catcher is preferably a yarn spool that is rotatably supported with little friction and is set into rotation by the yarn. This makes accurate yarn tension measurements possible without incorrectly reading the yarn tension of the moving yarn.~~

[0007] The measuring position of the yarn catcher is preferably defined by a stop means so that the position is maintained precisely, regardless of the user's skill or any tolerances in the actuating mechanism. The stop means is, for instance, a stop face, peg, protrusion, or the like, that defines the path of motion of the yarn catcher.

~~The measuring position of the yarn catcher is preferably defined by a stop means, so that the position is maintained precisely, regardless of the user's skill or any tolerances in the actuating mechanism. The stop means is for instance a stop face, peg, protrusion, or the like, that defines the path of motion of the yarn catcher.~~

[0008] The yarn catcher preferably is a pivotably supported lever. Alternatively, however, displaceable, linearly movable elements or the like can be used. However, utilizing a pivot lever as the yarn catcher has the advantage that a yarn can be taken up and shifted to the measuring position easily.

~~The yarn catcher is preferably a pivotably supported lever. Alternatively, however, displaceable, linearly movable elements or the like can be used. However, embodying the yarn catcher as a pivot lever has the advantage that a yarn can be taken up and shifted to the measuring position especially easily.~~

[0009] The yarn guide element can be connected not only with ~~the~~ a yarn tension meter and indicator, but also with a sensor device, such as a rotary position sensor or an rpm sensor. As a result, the yarn speed, yarn quantity, and the like all can ~~all~~ be measured.

[0010] The yarn tension indicator meter preferably has a yarn applicator element, embodied as a pin, for instance a ceramic pin, which extends substantially parallel to the axis of rotation of the lever and transversely to the yarn ~~travelling~~ traveling through. The pin can be supported directly by a force sensor. No perceptible motion of the pin occurs under the influence of the force originating at the deflected yarn, and as a result the yarn tension meter responds quickly and precisely.

[0011] The yarn tension meter is preferably connected to a processing device~~,~~ disposed in the hand-operated measuring instrument inside the housing~~; the~~. The processing device is connected to a display device~~. The display device,~~ which together with a control knob, serves to control the yarn measuring device. The control knob ~~is~~, which preferably ~~set up~~is adopted for one-handed operation~~. This is achieved by embodying it as~~, may be in the form of a knob~~/~~ or pushbutton. The setup of various measurement specifications can be done by way of a menu guide specified by the processing device. The selection of menu items can be made by rotating the control knob, and the selection of menu items can be done by depressing the control knob.

[0012] The processing device ~~makes an~~ provides enhanced functionality ~~possible.~~. For instance, yarn tension can be measured in various units, such as average yarn tension, peak yarn tension, and so forth. The deviation from a normal tension ~~can~~ also can be displayed. It is furthermore possible to display the yarn length in various units, such as meters, inches, and yards. It is ~~furthermore~~also possible to display the yarn speed in different units both as an average value and a peak value and to display fluctuations in the yarn speed.

[0013] In an advantageous embodiment, the processing device ~~is~~, furthermore~~,~~ is connected to an interface which can receive signals from an external source. The interface can be embodied as a plug connector device for cables, or it can be cordless. For instance, signals can ~~arrive~~be received here that characterize the rotary speed of the machine. The processing device can thus determine weighted variables, such as yarn length per machine revolution, and display them.

[0014] For the power supply to the processing device, the hand-operated measuring instrument has one or more batteries or accumulators. These are preferably ~~embodied~~contained in the housing, such as in a battery compartment ~~whose~~with closure lid ~~at the same time forms the~~that also serves as an actuating member or device. The actuating mechanism can serve as a locking device, which unlocks the closure lid ~~as soon as~~when the lid~~, for transferring the yarn catcher from its tuck position into the measuring position,~~ is pressed onto the housing or into ~~it.~~an actuating position. Unlocking of the closure lid is no problem then, because it is held by the user's hand. However, as soon as it is released, it snaps back into its initial position, in which it is once again ~~it is~~ locked by the actuating mechanism. If it needs to be removed, this can be done by holding the yarn catcher in its measuring position while the actuating device is released.

[0015] ~~Further details of advantageous embodiments~~Other objects and advantages of the invention will become apparent ~~from~~ upon reading the ~~drawing, the~~ following detailed description~~, and the dependent claims. One exemplary embodiment of the invention is shown~~ and upon reference to the drawings, in ~~the drawing. Shown are~~ which:

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] FIGURE. 1 ~~Fig,~~ is a side elevational view of a yarn measuring device~~,~~ in ~~a side view~~ accordance with the invention;

[0017] Fig. 2~~,~~ is an enlarged plan view of the yarn measuring device ~~of~~ shown in Fig. 1 ~~on a different scale, in plan view~~;

[0018] Fig. 3~~,~~ is an enlarged fragmentary view of the yarn guide end of the illustrated yarn measuring device ~~of Fig. 2 on a different scale, in a fragmentary and partly cutaway view~~;

[0019] Fig. 4~~, the yarn catcher~~ is a fragmentary section of the illustrated yarn measuring device showing a yarn catcher thereof in ~~the~~a first or tuck position;

[0020] Fig. 5~~,~~ is a fragmentary section, similar to Fig. 4, showing the yarn catcher ~~of the yarn measuring device~~ in ~~the~~a second or measuring position;

[0021] Fig. 6~~,~~ is a longitudinal section of the illustrated yarn measuring device ~~in a schematic longitudinal section~~ showing ~~the~~ an actuating member of the device in ~~the~~an unactuated ~~state;~~position;

[0022] Fig. ~~7, the yarn measuring device of Fig.~~7 is a longitudinal section, similar to Fig. 6, showing the actuating member device in ~~the actuation~~an actuated position;

[0023] Fig. 8~~,~~ is a schematic longitudinal section of the illustrated yarn measuring device ~~of Figs. 6 and 7 with the~~ showing a battery compartment ~~closure~~ lid removed from the handle of the device; and

[0024] Figs. 9-11~~,~~ illustrate various displays ~~appearing~~that appear on the yarn measuring device during usage.

~~In Fig. 1, a yarn measuring device 1 is shown which has an elongated housing 2, bent at an obtuse angle, with two housing portions 3, 4. The longer housing portion 4 serves as a handle. On its back side, which faces the user during use, there are a display 5 and a control knob 10. On its front side, which points away from the user, there is a displaceably or pivotably supported trip lever 6. This lever can be embodied in shell form as a housing portion or housing part and, as will become clearer hereinafter, can at the same time serve as a battery compartment lid.~~

[0025] While the invention is susceptible of various modifications and alternative constructions, certain illustrated embodiments thereof have been shown in the drawings and will be described below in detail. It should be understood, however, that there is no intention to limit the invention to the specific forms disclosed, but on the contrary, the intention is to cover all modifications, alternative constructions and equivalents falling within the spirit and scope of the invention.

~~On its front free end 7, the yarn measuring device 1 has a yarn catcher 8, which includes a pivotably supported lever 9. The lever 9, which can be seen in plan view in Fig. 2, is disposed between two forklike legs 12, 14 of the housing portion 3, which define a passage 11. On its free end 15, the lever 9 has a yarn guide element 16, in the form of a rotatably supported yarn spool 17 whose axis of rotation 18 is oriented parallel to the pivot axis 19 of the lever 9 (Fig. 3). The yarn catcher 8 formed by the lever 9 is pivotable between two positions I, II, which are shown in Figs. 4 and 5. The pivoting angle α is preferably somewhat less than 180°. Position I is a tuck position, in which an imaginary connecting line between the axis of rotation 18 and the pivot axis 19 is at approximately right angles to a yarn 21 that is to be sensed. The other position II (Fig. 5) is the measuring position, in which the lever 9 rests on a stop peg 22.~~

DETAILED DESCRIPTION OF PREFERRED EMBODIMENT

[0026] Referring now more particularly to the drawings, there is shown an illustrative yarn measuring device 1 in accordance with the invention, which as will be understood by one skilled in the art, is adaptable for use with yarn being processed through a yarn knitting or other processing machine. The yarn measure device 1 in this case has an elongated housing formed by two housing portions 3, 4 bent an at obtuse angle with respect to each other. The longer housing portion 4 serves as a handle. On its back side, which faces the user during use, there are a display 5 and a control knob 10. On its front side, which faces away from the user, there is a displaceably or pivotably supported trip lever 6. This lever can

be a housing portion or housing part in the form of a shell and, or as will become apparent hereinafter, can at the same time serve as a battery compartment lid.

~~A yarn guide element 23 in the form of a rotatably supported yarn spool 24 is disposed concentrically to the pivot axis 18, or in the immediate vicinity thereof, and like the yarn spool 17, it has a yarn groove. The yarn grooves of the yarn spools 17, 24, as Fig. 3 shows, are disposed in a common plane E, to which the pivot axis 19 and the axis of rotation 18 are perpendicular. The yarn spool 24 is connected for instance to a rotation transducer 25. The rotation transducer outputs electrical signals in accordance with the rotation of the yarn spool 27. The rotation transducer 25 is connected to a processing device, not further shown here, which is accommodated in the form of a microcomputer, for instance on the printed circuit board 26 that can be seen in Figs. 6 and 7. The processing device 26 is connected with the display 5, which is used for equipment setup, operation, and display of measured values.~~

[0027] On its front free end 7, the yarn measuring device 1 has a yarn catcher 8, which includes a pivotably supported lever 9. The lever 9, as depicted in Fig. 2, is disposed between two forklike legs 12, 14 of the housing portion 3, which define a passage 11. On its free end 15, the lever 9 has a yarn guide element 16, in the form of a rotatably supported yarn spool 17 whose axis of rotation 18 is oriented parallel to the pivot axis 19 of the lever 9 (Fig. 3). The yarn catcher 8 formed by the lever 9 is pivotable between two positions I, II, which are shown in Figs. 4 and 5, respectively. The pivoting angle α is preferably somewhat less than 180°. Position I depicted in Fig. 4 is a tuck position in which an imaginary connecting line between the axis of rotation 18 and the pivot axis 19 (Fig. 3) is at approximately right angles to a yarn 21 that is to be sensed. The other position II (Fig. 5) is the measuring position in which the lever 9 rests on a stop peg 22.

[0028] ~~As Fig. 5 shows, between the yarn guide element 23 and the yarn guide element 16 that is in the measuring position, there is a yarn applicator element 27, in the form of a pin 28 that extends approximately parallel to the pivot axis 19 (Fig.~~A yarn guide element 23 in the form of a rotatably supported yarn spool 24 is disposed concentrically to the pivot axis 18, or in the immediate vicinity thereof, and like the yarn spool 17, it has a yarn groove. The yarn grooves of the yarn spools 17, 24, as shown in Fig. 3~~). With its free end, the pin 28 protrudes into~~, are disposed in a common plane E, to which the pivot axis 19 and the ~~passage 11, and on its other end it is connected to a force sensor 29. The force sensor 29 and the pin 28 form a yarn tension meter 31. This yarn tension meter is connected to the processing device and sends electrical signals to it that correspond to the yarn tension detected. As Fig. 5 shows, the pin 28 is disposed above a tangent that connects the yarn spool 24 with the yarn~~

~~spool 17, so that the yarn 21 travelling through travels over the pin 28 at an obtuse angle. The precise size of this angle is defined by the position of the stop peg 22.~~axis of rotation 18 are perpendicular. The yarn spool 24 in this instance is connected to a rotation transducer 25. The rotation transducer, which may be of known type, outputs electrical signals in accordance with the rotation of the yarn spool 27. The rotation transducer 25 is connected to an appropriate processing device such as a microcomputer, having, for example, a printed circuit board 26, as depicted in Figs. 6 and 7. The processing device 26 is connected with the display 5, which can be used for equipment setup, operation, and display of measured values.

[0029] As shown in Fig. 5, between the yarn guide element 23 and the yarn guide element 16 when in the measuring position, there is a yarn applicator element 27 in the form of a pin 28 that extends approximately parallel to the pivot axis 19 (Fig. 3). A free end 7 the pin 28 protrudes into the passage 11, and on the other end of the pin 28 is connected to a force sensor 29. The force sensor 29 and the pin 28 form a yarn tension meter 31. This yarn tension meter is connected to the processing device and sends electrical signals to it that correspond to the yarn tension detected. As shown in Fig. 5, the pin 28 is disposed above a tangent that connects the yarn spool 24 with the yarn spool 17 so that the yarn 21 traveling through travels over the pin 28 at an obtuse angle. The precise size of this angle is defined by the position of the stop peg 22. The lever 9 is ~~provided~~ formed with a funnel-shaped cutout 32, which when the lever 9 is pivoted into the measuring position is located above the pin 28 without touching it.

[0030] ~~The pivoting~~ Pivotable movement of the lever 9 is effected by actuation of the trip lever 6, which in this sense forms an actuating ~~device. Figs. 6 and 7 show one exemplary embodiment of the~~ member. An associated actuating mechanism 33~~, which~~ connects the trip lever 6 to the lever 9~~.~~, as depicted in Figs. 6 and 7. The illustrated actuating mechanism 33 includes a gear wheel 34, which is connected to the lever 9 in a manner fixed against relative rotation and meshes with a rack 35 that is supported axially displaceably in the housing 2. ~~With its~~ The other end the rack 35 meshes with a gear wheel 36 that is rotatably supported in the housing 2. The gear wheel 36 meshes with a rotatably supported gear wheel 37, which ~~is rotatably supported but connected in a manner fixed against relative rotation to~~has a lever 38~~.~~ fixedly secured thereto. This lever 38 has a hook-shaped end 39 which~~,~~ in ~~the~~a deactivated position ~~of repose,~~, has a luglike extension 41 that engages an opening 42 of the ~~trip~~ lever 6 ~~with a luglike extension 41.~~. The trip lever, which is constructed in shell form~~; on one end, it~~, has a peg ~~protruding laterally away from it, or some~~ similar protrusion; extending laterally away from one end for pivotable support in a sliding-block guide 43. The opening 42 is oriented approximately radially to the pivot axis thus defined by the sliding-block guide 43,

which axis is approximately perpendicular to the plane of ~~the drawing in~~ Fig. 6. The lever 38 is disposed such that the protrusion 41 moves out of the opening 42 when the lever 6 is pressed ~~onto~~ into the housing 2 ~~and into it. In that process.~~ During such movement, a front wall 44 presses against the lever 38, even if the protrusion 41 has moved out of the opening 42. In ~~the~~ such position ~~of repose~~, the trip lever 6 preferably forms an obtuse ~~or acute~~ angle with the lever 38. A tension spring 45 in this case pre-stresses the rack 35 in a selected longitudinal direction such that the lever 9 is biased toward its tuck position I.

~~At some suitable point, the actuating mechanism 33 has a spring means. For instance, this spring means can be embodied by a tension spring 45, which prestresses the rack 35 in a selected longitudinal direction in such a way that the lever 9 is prestressed toward its tuck position I.~~

[0031] The trip lever 6 preferably may form a battery compartment lid. In the illustrated embodiment it spans a battery compartment 46 located beneath it, in which one or more batteries 47, 48 are disposed for supplying power to the processing device. The batteries can be supported by the printed circuit board 26. The printed circuit board has an additional switch that activates the processing device. The actuating mechanism 33 in this case has a certain amount of play or elasticity, which makes further depression of the trip lever 6 possible for activating the switch 49, once the lever 9 has reached its measuring position II.

~~The trip lever 6 is embodied as a battery compartment lid. It spans a battery compartment 46 located beneath it, in which one or more batteries 47, 48 are disposed for supplying power to the processing device. The batteries can be supported by the printed circuit board 26. The printed circuit board for instance has an additional switch that activates the processing device. The actuating mechanism 33 preferably has a certain amount of play or elasticity, which makes further depression of the trip lever 6 possible for activating the switch 49, once the lever 9 has reached its measuring position II.~~

[0032] The yarn measuring device 1 described thus far functions as follows:

[0033] The yarn measuring device 1 ~~described thus far functions~~is switched on when pressure is exerted on the control knob 10 as ~~follows:~~will be understood by a person skilled in the art. Alternatively or in addition, the yarn measuring device 1 be switched on by actuation of the trip lever 6. The yarn measuring device is automatically switched off once a waiting period has elapsed without further actuation, or alternatively by holding the control knob down longer. The display 5 is shown in Fig. 9 at the top left with all the display options. By

twisting and/or pressing on the control knob 10 (depending on the embodiment), the three fundamental operating modes of measurement (MEASURE), storage and memory (MEM) and setup (SETUP) can be selected. The menu used for the measurement is shown in Fig. 9 in the left-hand column, line 2. If it is activated, the measurement of the rotary machine speed, yarn length, yarn tension, and yarn speed can be selected. Line 2 in Fig. 9 illustrates various displays, for instance for average rpm or current rpm (third and fourth columns). The first line, conversely, shows various setups (SETUP), for instance for the unit selected (m/min, m, yd/min, or inch).

~~The yarn measuring device 1 is switched on when pressure is exerted on the control knob 10. Alternatively or in addition, it can be provided that the yarn measuring device 1 be switched on by actuation of the trip lever 6. The yarn measuring device is automatically switched off once a waiting period has elapsed without further actuation, or alternatively by holding the control knob down longer. The display 5 is shown in Fig. 9 at the top left with all the display options. By twisting and/or pressing on the control knob 10 (depending on the embodiment), the three fundamental operating modes of measurement (MEASURE), storage and memory (MEM) and setup (SETUP) can be selected. The menu used for the measurement is shown in Fig. 9 in the left-hand column, line 2. If it is activated, the measurement of the rotary machine speed, yarn length, yarn tension, and yarn speed can be selected. Line 2 in Fig. 9 illustrates various displays, for instance for average rpm or current rpm (third and fourth columns). The first line, conversely, shows various setups (SETUP), for instance for the unit selected (m/min, m, yd/min, or inch).~~

[0034] Similarly, the measurement of the yarn length can be selected in various operating modes (Fig. 9, third line, second column, through fifth line, first column). The menus and displays on the display 5 for the yarn tension can be seen in Fig. 9, fifth line, second column, through Fig. 10, third line, second column. The other displays pertain to the yarn speed.

[0035] ~~Similarly, the measurement of the yarn length can be selected in various operating modes (Fig. 9, third line, second column, through fifth line, first column). The menus and displays on the display 5 for the yarn tension can be seen in Fig. 9, fifth line, second column, through Fig.~~ Once the desired measurement mode has been selected, the yarn measuring device is brought to the yarn, as shown in Fig. 4, until the yarn spool 17 engages the yarn 21 from behind. If the trip lever 6 is now actuated, the lever 9 pivots out of its tuck position I into its measuring position II, as shown in Fig. 5. In the process, the lever 9 presses against the stop peg 22 and thus assumes a defined position. In that position, the yarn 21 travels over the pin 28, and a force corresponding to the yarn tension is recorded at the force

sensor 29. This force is converted by the processing device into a yarn tension value and shown on the display 5; see Fig. 9 or 10~~, third line, second column. The other displays pertain to the yarn speed.~~. Depending on the selection chosen, the average tension, peak tension, rated tension, deviation from the rated tension, or the like can be displayed.

[0036] ~~Once the desired~~The actual measurement ~~mode has been selected, the yarn measuring device~~ is ~~brought to the yarn, as Fig. 4 shows, until the yarn spool 17 engages the yarn 21 from behind. If the trip~~activated when the control lever 6 is ~~now actuated, the~~ pressed firmly into the housing 2, once the lever 9 ~~pivots out of its tuck position I into~~ has reached its measuring position II~~, as Fig. 5 shows~~. The control lever 6 then actuates the switch 49 for performing the measurement. In ~~the process,~~its previous position, in which the lever 9 ~~presses against~~has already reached the stop peg 22 ~~and thus assumes a defined position. In that position, the yarn 21 travels over the pin 28, and a force corresponding to the yarn tension~~but the switch 49 is ~~recorded at the force sensor 29. This force is converted~~not yet actuated, the control lever 6 can be stopped if needed by ~~the processing device into a yarn tension value and shown on the display 5; see Fig. 9 or 10. Depending on the selection chosen, the average tension, peak tension, rated tension, deviation from the rated tension,~~means of an appropriate slide or the like ~~can be displayed~~.

~~The actual measurement is then activated when the control lever 6 is pressed firmly into the housing 2, once the lever 9 has already reached its measuring position II. The control lever 6 then actuates the switch 49 for performing the measurement. In its previous position, in which the lever 9 has already reached the stop peg 22 but the switch 49 is not yet actuated, the control lever 6 can be stopped if needed by means of a slide, not otherwise shown.~~

[0037] The printed circuit board 26, or the processing device disposed on it, can be provided, as shown Figs. 6 and 7, with an interface 51 in the form of a plug socket, provided on the lower end of the housing 2, or in the form of a wireless radio path. The interface 51 serves to carry signals (data) in and out. Such signals or data can represent the machine speed of a knitting machine connected to it or similar external data that are taken into account by the processing device. This makes it possible for instance to display the machine speed, as shown in Fig. 9, column 2, line 2 through column 1, line 3. Also, because external data are made available, it becomes possible to calculate and display pertinent variables, such as the yarn length per machine revolution (Fig. 9, column 2, line 3). Also via the interface 51, data can be sent onward as needed to some external device. This can be of value particularly when many yarns in succession must be scanned and monitored with the yarn measuring device 1.

~~The printed circuit board 26, or the processing device disposed on it, can be provided, as Figs. 6 and 7 show, with an interface 51 in the form of a plug socket, provided on the lower end of the housing 2, or in the form of a wireless radio path. The interface 51 serves to carry signals (data) in and out. Such signals or data can represent the machine speed of a knitting machine connected to it or similar external data that are taken into account by the processing device. This makes it possible for instance to display the machine speed, as shown in Fig. 9, column 2, line 2 through column 1, line 3. Also, because external data are made available, it becomes possible to calculate and display pertinent variables, such as the yarn length per machine revolution (Fig. 9, column 2, line 3). Also via the interface 51, data can be sent onward as needed to some external device. This can be of value particularly whenever many yarns in succession must be scanned and monitored with the yarn measuring device 1.~~

[0038] Changing the batteries 47, 48 is effected as follows:

~~Changing the batteries 47, 48 is done as follows:~~

[0039] If the battery compartment 46 is to be opened, the trip lever 6 is pressed into the housing 2. In the process, the protrusion 41 moves out of the opening 42 so that there is no longer any locking or other positive engagement between the trip lever 6 and the lever 38. The trip lever 6 that forms the battery compartment lid cannot fall off, however, because it is firmly held by the fingers of the user, who must hold the trip lever 6 against the force of the tension spring 45. For removing the battery compartment lid, the lever 9 is now held, for instance, by hand in its measuring position, while the trip lever 6 is released. Because the lever 38 stays in its deflected position, visible in Fig. 7, the lid can now be freely removed. This can be seen from Fig. 8.

[0040] ~~If the~~The battery compartment ~~46~~lid is installed in reverse order. The lever 9 is shifted to the measuring position II, after which the trip lever 6 can be ~~opened, the trip lever 6 is pressed~~inserted into the ~~housing 2. In the process, the protrusion 41 moves out of the~~ opening ~~42, so that there is no longer any locking or other positive engagement between the trip lever 6 and the lever 38. The trip lever 6 that forms~~ in the battery compartment~~lid cannot fall off, however, because it is firmly held by the fingers of the user, who must hold the trip lever 6 against the force of the tension spring 45. For removing the battery compartment lid, the lever 9 is now held for instance by hand in its measuring position, while the trip lever 6 is released. Because the lever 38 stays in its deflected position visible in Fig. 7, the lid can now~~

~~be freely removed. This can be seen from Fig. 8.~~ If the lever 9 is released, the lever 38 catches on the trip lever 6 and in turn keeps the trip lever in place.

~~The battery compartment lid is installed in reverse order. The lever 9 is shifted to the measuring position II, after which the trip lever 6 can be inserted into the opening in the battery compartment. If the lever 9 is released, the lever 38 catches on the trip lever 6 and in turn keeps the trip lever in place.~~

~~The yarn measuring device 1 of the invention is a hand operated measuring instrument, with a yarn catcher 8 which, when a trip lever 6 is tripped, places the yarn over a yarn applicator element 27 of a force sensor 29. The yarn tension detected, like the yarn speed detected, is delivered to a processing device for display and further processing. The device makes one-handed operation possible. The boomerang-shaped housing 2 is embodied on one end as a handle, on which a trip lever, a control knob 10 embodied as a knob/pushbutton, and a display 5 are all disposed. The control knob 10 can be twisted and depressed by the user's thumb, so that full operation, that is, the selection of all the measurement and operating modes, can be done with only the thumb. The measurement is performed by means of the trip lever 6, which actuates both the yarn catcher 8 and a measurement activation switch 49.~~comprising:

[0041] From the foregoing, it can be seen that the yarn measuring device 1 of the invention is a hand- operated measuring instrument, with a yarn catcher 8 which, when a trip lever 6 is tripped, places the yarn over a yarn applicator element 27 of a force sensor 29. The yarn tension detected, like the yarn speed detected, is delivered to a processing device for display and further processing. The device makes one-handed operation possible. The boomerang- shaped housing 2 is embodied on one end as a handle, on which a trip lever, a control knob 10 in the form of a knob/pushbutton, and a display 5 are all disposed. The control knob 10 can be twisted and depressed by the user's thumb so that full operation, that is, the selection of all the measurement and operating modes, can be done with only the thumb. The measurement is performed by means of the trip lever 6, which actuates both the yarn catcher 8 and a measurement activation switch 49.

~~List of Reference Numerals:~~

~~1 Yarn measuring device~~
~~2 Housing~~
~~3, 4 Housing portions~~

~~5 Display~~
~~6 Trip lever~~
~~7 End~~
~~8 Yarn catcher~~
~~9 Lever~~
~~10 Control knob~~
~~11 Passage~~
~~12, 14 Legs~~
~~15 End~~
~~16 Yarn~~
~~17 Yarn spool~~
~~18 Axis of rotation~~
~~19 Pivot axis~~
~~21 Yarn~~
~~22 Stop peg~~
~~23 Yarn guide element~~
~~24 Yarn spool~~
~~25 Rotation transducer~~
~~26 Processing device~~
~~27 Yarn applicator element~~
~~28 Pin~~
~~29 Force sensor~~
~~31 Yarn tension sensor~~
~~32 Cutout~~
~~33 Actuating mechanism~~
~~34 Gear wheel~~
~~35 Rack~~
~~36, 37 Gear wheel~~
~~38 Lever~~
~~39 End~~
~~41 Protrusion~~
~~42 Opening~~
~~43 Sliding block guide~~
~~44 Wall~~
~~45 Tension spring~~
~~46 Battery compartment~~
~~47, 48 Batteries~~

~~49 Switch~~

~~E Plane~~

~~Claims:~~

~~1. A yarn measuring device (1), in particular for freehand measurements, having a housing (2) which has a handle (4) with an actuating device (6), having a yarn catcher (8), which is supported movably between two positions (I, II), of which one is a tuck position (I) and the other is a measuring position (II), and is connected to the actuating device (6) via an actuating mechanism (33), having a yarn guide element (23), which is disposed at a point between the two positions (I, II), andhaving a yarn tension meter (31), which is disposed at a point between the measuring position (II) and the yarn guide element (23).~~

~~2. The yarn measuring device of claim 1, characterized in that theyarn catcher (8) has a pivotably supported lever (9), which on its free end has a yarn guide element (16).~~

~~3. The yarn measuring device of claim 2, characterized in that the yarn guide element (16) is a rotatably supported yarn spool (17).~~

~~4. The yarn measuring device of claim 1, characterized in that the measuring position (II) of the yarn catcher (8) is defined by a stop means (22).~~

~~5. The yarn measuring device of claim 1, characterized in that the yarn guide element (23) is a rotatably supported yarn spool (24), which is connected to a sensor (25).~~

~~6. The yarn measuring device of claim 5, characterized in that the sensor (25) is a rotary position sensor or an rpm sensor.~~

~~7. The yarn measuring device of claim 1, characterized in that the yarn tension meter (31) has a yarn applicator element (27), which is connected to a force sensor (29).~~

~~8. The yarn measuring device of claim 2 and 7, characterized in that the yarn applicator element (27) is a pin, which extends essentially parallel to the pivot axis (19) of the lever (9) and is supported by the force sensor (29).~~

~~9. The yarn measuring device of claim 1, characterized in that the yarn tension meter (31) is connected to a processing device.~~

~~10. The yarn measuring device of claim 9, characterized in that the processing device is connected to a display device.~~

~~11. The yarn measuring device of claim 9, characterized in that the processing device is connected to a control switch, whose control knob (10) is disposed on the handle (4).~~

~~12. The yarn measuring device of claim 11, characterized in that the control switch is a knob/pushbutton.~~

~~13. The yarn measuring device of claim 10, characterized in that the processing device, for setting up various operating modes on the display device (5), furnishes a menu-oriented input.~~

~~14. The yarn measuring device of claim 1, characterized in that the processing device has an interface (51) for receiving external signals.~~

~~15. The yarn measuring device of claim 1, characterized in that the processing device has an interface (51) for outputting signals to an external device.~~

~~16. The yarn measuring device of claim 1, characterized in that the housing (2) has two elongated legs (3, 4), which form an obtuse angle with one another.~~

~~17. The yarn measuring device of claim 16, characterized in that on its free end (7) one of the legs (3, 4), has the yarn catcher (8), and the other leg (4) serves as the handle.~~

~~18. The yarn measuring device of claim 1, characterized in that a battery compartment (46) for at least one supply battery (47, 48) is disposed in the handle.~~

~~19. The yarn measuring device of claim 18, characterized in that the battery compartment (46) has a closure lid, which simultaneously forms the actuating device (6).~~

~~20. The yarn measuring device of claim 19, characterizedin that the actuating mechanism (33) is in positive engagement with the unactuated actuating device (6) by means of a locking bar (41), in order to secure the actuating device in place.~~

~~21. The yarn measuring device of claim 20, characterized in that by the actuation of the actuating device (6), the locking bar (41) is moved transversely to a portion (44) of the actuating device (6), in order to unlock the latter.~~

CLAIM(S):

1. A hand held yarn measuring device comprising:

a housing (2) having a handle (4) with an actuating member (6),

a yarn catcher (8) supported by the housing (2) for movement between a first tuck position (I) and a second measuring position (II),

an actuating mechanism (33) connecting said actuating member (6) to said yarn catcher (8),

a yarn guide element (23) disposed at a location between said two yarn catcher positions (I, II) and

a yarn tension indicator (31) disposed at a point between the yarn catcher measuring position (II) and the yarn guide element (23).

2. The yarn measure device of claim in which said yarn catcher (8) includes a pivotably supported lever (9) having a yarn guide element (16) at a free end of said lever (9).

3. The yarn measure device of claim 2 in which said yarn guide element (23) is a rotatably supported yarn spool (17).

4. The yarn measure device of claim 1 including a stop member (22) for defining the yarn catcher measuring position (II).

5. The yarn measure device of claim 1 in which said yarn guide element (23) is a rotatably supported yarn spool (24), and said yarn spool (24) is connected to a sensor (25).

6. The yarn measure device of claim 5 in which said sensor (25) is a rotary position sensor.

7. The yarn measure device of claim 5 in which said sensor (25) is an rpm sensor.

8. The yarn measuring device of claim 1 in which said yarn tension indicator (31) includes a yarn applicator element (27) connected to a force sensor (29).

9. The yarn measure device of claim 8 in which said yarn applicator element (27) is a pin extending parallel to a pivot axis (19) of the lever and supported by said force sensor (29).

10. The yarn measuring device of claim 1 in which said yarn tension indicator (31) is connected to a processing device.

11. The yarn measuring device of 10 in which said processing device is connected to display device.

12. The yarn measuring device of claim 10 in which said processing device is connected to a control switch having a control knob (10) disposed on said handle (4).

13. The yarn measuring device of claim 10 in which said processing device is connected to a control switch having a push button actuator disposed on said handle (4)..

14. The yarn measuring device of claim 11 in which said processing device has a menu oriented input for setting various operating modes on the display device.

15. The yarn measuring device of claim 10 in which said processing device has an interface (51) for receiving signals external to the yarn measuring device.

16. The yarn measuring device of claim 10 in which said processing has an interface (51) for outputting signals to an external device.

17. The yarn measuring device of claim 1 in which said housing (2) has two elongated legs (3, 4) that form an obtuse angle with one another.

18. The yarn measuring device of claim 17 in which said yarn catcher (8) is supported by a free end of one of said legs (3, 4) and the other leg (4) serves as said handle.

19. The yarn measuring device of claim 1 including battery compartments (46) for at least one supply battery (47, 48) disposed in said handle.

20. The yarn measuring device of claim 19 in which said actuating member (6) forms a closure lid for said battery compartment (46).

21. The yarn measuring device of claim 20 in which said actuating member (6) is moveable between an actuating position and an unactuated position, and said actuating mechanism (33) positively engages and secures said actuating member (6) when in said unactuated position.

22. The yarn measuring device of claim 21 in which said actuating mechanism has a locking bar (41) that positively engages said actuating member (6) when in said unactuated position.

23. The yarn measure device of claim 22 in which said locking bar (41) is moved transversely to and disengages from the actuating member (6) in response to movement of said actuating member (6) from said unactuated position to said actuated position.

24. A hand held yarn measuring device comprising:

a housing (2) having a handle (4) with a selectively actuatable actuating member (6),

a yarn guide (23) rotatably supported by said housing,

a pivot lever (9) mounted for pivotable movement about the rotary axis of said yarn guide element (23),

an actuating mechanism (33) connecting said actuating member (6) to said pivot lever (9),

said pivot lever (9) having a yarn guide spool (17) at a free end thereof for positioning into contacting relation with a moving yarn,

a tension indicator (31) supported by said housing, and

said actuating member (6) being actuatable to cause said actuating mechanism (33) to pivot said pivot lever to a position that causes said moving yarn to simultaneously engage said yarn guide element (23) and said tension indicator (31).

25. The yarn measure device of claim 24 in which said yarn guide element (23) is a rotatably supported yarn spool (24), and said yarn spool (24) is connected to a sensor (25).

26. The yarn measure device of claim 25 in which said sensor (25) is a rotary position sensor.

27. The yarn measuring device of claim 24 in which said yarn tension indicator (31) includes a yarn applicator element (27) connected to a force sensor (29).

28. A hand held yarn measuring device comprising:

a housing (2) having a handle (4) with a selectively actuatable actuating member (6),

a yarn catcher (8) supported by said housing (2) for movement between a first position that permits contact with moving yarn and a second measuring position,

an actuating mechanism (33) connecting said actuating member (6) to said yarn catcher (8),

a first yarn guide indicator for measuring the speed of said moving yarn,

a second yarn indicator for measuring the tension of the moving yarn, and

said yarn catcher being moveable from said first position to said second position in response to actuation of said actuating member (6) for causing said moving yarn to simultaneously engage said first and second indicators.

29. The yarn measuring device of claim 28 in which said yarn tension indicator (31) connected to a processing device.

30. The yarn measuring device of claim 29 in which said processing device connected to a display device pm said housing.

31. The yarn measuring device of claim 30 in which said processing device is connected to a control switch having a control knob (10) disposed on said handle (4).

~~Abstract:~~

~~The yarn measuring device (1) of the invention is a hand-operated measuring instrument, with a yarn~~

ABSTRACT OF THE DISCLOSURE

A handheld yarn measuring device (1) for monitoring yarn in yarn processing machines. The yarn measuring device includes a catcher (8), which when a trip lever (6) is ~~tripped~~ actuated, places the yarn over a yarn applicator element (27) of a force sensor (29). The yarn tension ~~detected, like the yarn~~ and speed ~~detected,~~ is detectable and delivered to a processing device for display and further processing. The device ~~makes~~, which may be operated by one~~-handed operation possible. The~~ hand, has a boomerang-shaped housing (2) ~~is embodied on~~ one end ~~as a handle, on which a~~ of which supports the trip lever (6), a control knob (10) ~~embodied as a knob/pushbutton,~~ and a display (5~~) are all disposed.~~). The control knob (10) can be twisted and depressed by the ~~user's~~ user's thumb~~,~~ so that ~~full operation, that is,~~ the selection of all the measurement and operating modes~~,~~ can be done with only the thumb. The measurement is performed by means of the trip lever (6), which actuates both the yarn catcher (8) and a measurement activation switch (49).

~~(Fig. 6)~~

AMENDMENTS TO THE TITLE

Replace the title with: HAND HELD YARN MEASURING DEVICE~~, IN PARTICULAR FOR NONSTATIONARY APPLICATIONS~~